eties of these elements, each of which has special merits for certain conditions and is utterly unsuited for others. In addition to the principal elements above enumerated each power plant must contain various accessory machines, as for instance, pumping installations for feed water, condensers, etc., and under certain conditions it is economical and desirable to supply various appliances for regenerating or saving heat which would otherwise be wasted, such as feed water heaters, economizers and coverings for pipes. When it is further considered that there are several special manufacturers for each of the minor kind of machines, one can readily understand that the field, which is open to Dr. Hutton, is a very extensive one.

In Dr. Hutton's treatment of the problem a full description has been given of the principal forms of boilers, various boiler accessories, furnaces, chimneys and setting, also systems of piping and the accessories for the removal of water and oil.

The principal portion of the work is devoted to "steam-using" machinery and its accessories. In this part full descriptions are given of the principal forms of piston engine and steam turbines, and also a discussion of the theory of action of these machines. The pumping machinery, condensers, construction of foundations, are also thoroughly considered.

The book contains 825 pages and nearly 700 illustrations.

The reader of the work is quite likely to regret that so much space is given to the description and theory of various elements of the power plant, all of which matter can be readily found in special treatises which find a place in practically every mechanical engineer's library, and on the other hand, that so little space is given to the proportioning and coordination of the various elements with each other and to the practical commercial problems which must be worked out in connection with the erection of every plant.

On the whole the book will prove useful to any one engaged in the study of the problem of supplying machinery for the production of power.

Professor Hutton states in his preface that the object of the book is largely the study of "function and purpose of power plant apparatus," and from that standpoint the book is certainly a successful treatise.

What Professor Hutton states respecting the future displacement of the piston steam engine by the steam turbine is doubtless true and is, I believe, of general interest. He states in effect in his preface that the steam turbine has a special field which is limited in a large measure to large units and to the use of electrical transmission and that the piston engine will always be superior for smaller units, and where a large starting torque is necessary, and he also could have added where a vacuum is not possible.

The question has often been raised by the public and investors as to the possible displacement of steam machinery by the internal combustion or gas engine. Dr. Hutton shows that such displacement is not probable, for although the thermal efficiency is higher in the internal combustion engine than in the steam engine, the cost of fuel per unit is generally greater and the repairs and maintenance are much higher. It is not probable that the internal combustion engine will ever replace the steam engine where large power units are necessary. The principal field of the internal combustion engine is that where small powers are required and where the prices of fuel per unit, labor or repairs would be offset by the extra amount of fuel or complications of a steam plant.

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An Introduction to Electricity. By BRUNO KOLBE. Being a translation of the second German edition (1904–5) by JOSEPH SKELLON. Cloth, 8vo, pp. viii + 430. Philadelphia, J. B. Lippincott Co.; London, Kegan Paul, Trench Trübner & Co. 1908.

This book is written in the form of lectures to a class of beginners with little preparation in either mathematics or mechanics. It begins with the electrification of amber, the oldest experiment known to electrical science,

and ends with a brief description of radioactive phenomena. This, together with interesting historical and practical matter, is contained in an appendix. The main body of the work is almost entirely taken up with the older and more fundamental portions of the pure science and some of its most important applications. The lectures are illustrated with abundant, but not too numerous, experiments, most of which are both excellent in themselves and described in a clear and interesting way. Many would do well to follow the author in his extensive use of the gold leaf, or aluminium leaf, electroscope provided with a scale; in discarding the torsion balance for a more modern instrument; in the use of amber as an insulator; and in the use of a straight wire sliding on metal rods across a magnetic field to show the motional electromotive force—all of which are fortunately becoming more and more common. The general plan of the work is good. Its style, though ordinarily clear, is marred by many obscurities and other infelicities of expression, many of them due to clumsiness of translation. Perhaps the most obscure paragraph in the book is that in which the action of the Holtz machine is explained. The author is particularly unhappy in the character and extent of his nomenclature for potential and fall of potential, *some* of his names for these quantities being electroscopic state, degree of electroscopic state, degree of electrification (even when the point whose potential is referred to is not on an electrified body), degree of electricity, intensity of electric field, measure of the degree of electrification in units of work, fall of electricity, fall of potential, polar difference, fall of the stream. This, however, is much the worst case of the kind that occurs. We read that a hollow metal ball can absorb electricity, that electricity is a puzzling force, that electric forces act on each other, of the conversion of electricity into work, and *vice versa;* and we find many other expressions entirely out of place in a work aiming to be scientific, and very objectionable anywhere else. The author wisely devotes but slight attention to the consideration of hypotheses; and fortunately, as it seems to the reviewer, for his treatment of several at least of those taken up appears far from sound. It is a more serious matter that the book is in error as to many matters of fact and theory too well established to question. Thus, for example, a very curious and erroneous explanation is given of the action of flames in discharging electrified bodies. Electric absorption is explained by the statement that the spark discharge takes place so quickly that all the electricity can not follow and a residuum remains. The influence machine is classed with the dynamo as a highly efficient source of electricity. The great advantage of the D'Arsonval galvanometer, called the solenoid galvanometer, is said to be that it does not have to be set up with its coil in the magnetic meridian. Self induction is explained as a particular case of mutual induction. All dynamos are said to give the best results when the resistance in the service conductor is equal to that in the windings of the machine, and we are told that stronger hard-soldered thermopiles are specially suitable for the charging of accumulators. One of the first errors made in the book is in the discussion of an experiment on capacity, which the author mistakes for an experiment on potential—a quantity which has led astray so many writers of elementary books. In this connection we read, as we have read in other books, that a positive body gives up electricity to the earth and that a negative body receives electricity from the earth; but we are not told what the earth itself does when it is either positively charged or negatively charged. No correct definition of the electromotive force of a generator is given, and no satisfactory derivation of Ohm's law for a closed circuit. Under the circumstances we are not surprised to read that Ohm's law does not hold for alternating currents. These matters are so fundamental, and so easy to treat properly, that the remissness of text-book writers is hard to understand. The statements in the appendix with reference to what should be called the electric intensity and the electric tension at the surface of a charged conductor are anything but satisfactory. The

dyne is wrongly defined, velocity is wrongly expressed. In a number of cases equalities and proportionalities are used indiscriminately. In fact, the book is logically weak, as would be expected from the author's statement that "inquiry into the rules of dynamics would carry us too far afield." Much dynamics and much mathematics are wholly unnecessary for the purposes of this work, yet its merits would be greatly increased by the more exact use of the little necessary. The book is provided with a good table of contents and a good index. It is well bound and excellently printed. The misprints noted by the reviewer are exceedingly few.

S. J. BARNETT

Arbeiten aus dem Gebiet der Experimentellen Physiologie. Herausgegeben von Dr. HANS FRIEDENTHAL in Nicolassee bei Berlin. Mit 4 Tafeln und 14 Figuren im Text. Jena, Gustav Fischer. Pp. 493. 1908. Price, 8 Marks.

This collection of papers by Dr. Friedenthal and his collaborators has been prepared in order to bring together a number of contributions scattered throughout various scientific journals, some of which are not easily accessible, and to make them readily available to physiological readers. They have been arranged by the editor, with relation to their content, into the following groups: biological relationships among animals and plants; papers on physiological operative technic, including studies on absorption, the innervation of the heart, and the sympathetic system; studies on physical and physico-chemical topics; papers on the H-ion concentration and the reaction of living substance; and additional contributions of diverse character.

It is impossible here to refer individually to the 55 papers reprinted. Many of them are already quite familiar to biological and physiological workers. This applies, for example, to studies such as those dealing with the fate of foreign sera introduced into the circulation of animals, and with the nature of the forces coming into play during the act of absorption. Friedenthal defends the view that solubility in water is per se insufficient to determine the possibility of absorption of substances by cells. We are asked to distinguish between solubility in protoplasm and solubility in water; herein the now well-recognized importance of the cell lipoids for the processes under discussion is duly emphasized. The author has furthermore especially insisted upon the absence of special "vital" forces in absorption.

Friedenthal's earlier observations on the biological relationships of animals and the position of man in the zoological scheme were perhaps not as widely known at the period of their publication as they deserved to be; the so-called "immunity" reactions which were shown in common for man and the anthropoid apes have since been more extensively observed.

Some of the observations on the occurrence and nature of enzymes have more recently lost the significance attributed to them when they were first published. Thus Friedenthal's announcement of the existence of an amylolytic enzyme in the gastric juice of dogs is probably referable to the regurgitation of intestinal contents (including pancreatic secretion) into the stomach—a phenomenon shown by Boldireff to occur with frequency in these animals.

The most significant of all the reprinted papers are, perhaps, those dealing with the reactions of the blood and protoplasm. Friedenthal was among those first to point out the non-existence of an alkaline reaction in the blood in reference to indicators sensitive to carbonic acid; and he showed the importance of the alkali bicarbonate of the serum as a regulatory factor in preventing marked variations from neutrality. These investigations were followed by the publication of a comparatively simple method for the estimation of the reaction of physiological fluids by the use of a series of indicators. The method, which has already found application in the study of physiological problems, is likely to be a help in future research, especially in the study of such questions as acidosis.

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